



PMV250EPEA

40 V, P-channel Trench MOSFET

20 June 2014

Product data sheet

1. General description

P-channel enhancement mode Field-Effect Transistor (FET) in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

2. Features and benefits

- Logic-level compatible
- Very fast switching
- Trench MOSFET technology
- 1 kV ESD protected
- AEC-Q101 qualified

3. Applications

- Relay driver
- High-speed line driver
- High-side load switch
- Switching circuits

4. Quick reference data

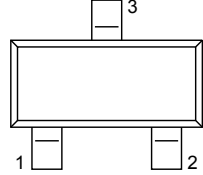
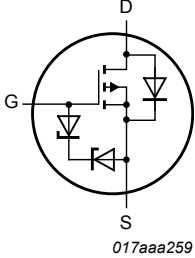
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j = 25\text{ °C}$	-	-	-40	V
V_{GS}	gate-source voltage		-20	-	20	V
I_D	drain current	$V_{GS} = -10\text{ V}; T_{amb} = 25\text{ °C}$	[1]	-	-1.5	A
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = -10\text{ V}; I_D = -1.3\text{ A}; T_j = 25\text{ °C}$	-	180	240	mΩ

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm².

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p>TO-236AB (SOT23)</p>	 <p>017aaa259</p>
2	S	source		
3	D	drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMV250EPEA	TO-236AB	plastic surface-mounted package; 3 leads	SOT23

7. Marking

Table 4. Marking codes

Type number	Marking code
PMV250EPEA	%JY

[1] % = placeholder for manufacturing site code

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	$T_j = 25\text{ °C}$		-	-40	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	$V_{GS} = -10\text{ V}; T_{amb} = 25\text{ °C}$	[1]	-	-1.5	A
		$V_{GS} = -10\text{ V}; T_{amb} = 100\text{ °C}$	[1]	-	-1	A
I_{DM}	peak drain current	$T_{amb} = 25\text{ °C};$ single pulse; $t_p \leq 10\text{ }\mu\text{s}$		-	-6	A
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$T_{j(\text{init})} = 25\text{ °C}; I_D = -0.26\text{ A};$ DUT in avalanche (unclamped)		-	5.5	mJ
P_{tot}	total power dissipation	$T_{amb} = 25\text{ °C}$	[2]	-	480	mW
			[1]	-	890	mW
		$T_{sp} = 25\text{ °C}$		-	6250	mW
T_j	junction temperature			-55	150	°C
T_{amb}	ambient temperature			-55	150	°C
T_{stg}	storage temperature			-65	150	°C
Source-drain diode						
I_S	source current	$T_{amb} = 25\text{ °C}$	[1]	-	-0.9	A
ESD maximum rating						
V_{ESD}	electrostatic discharge voltage	HBM	[3]	-	1000	V

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm^2 .

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[3] Measured between all pins.

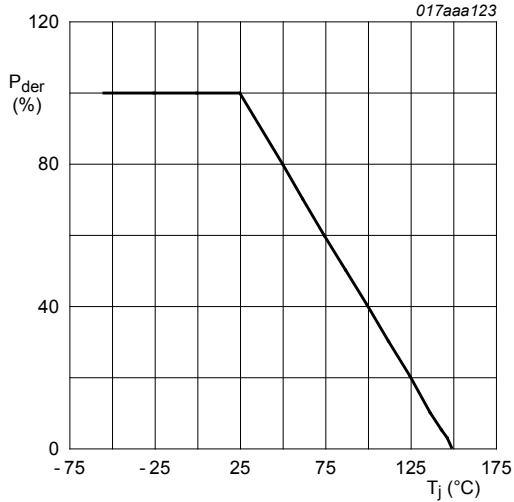


Fig. 1. Normalized total power dissipation as a function of junction temperature

$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ\text{C})}} \times 100 \%$$

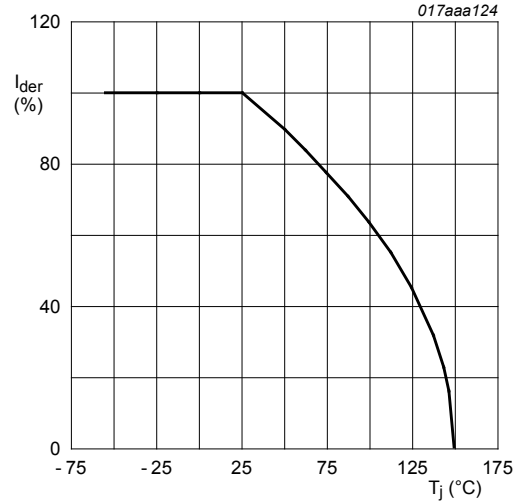
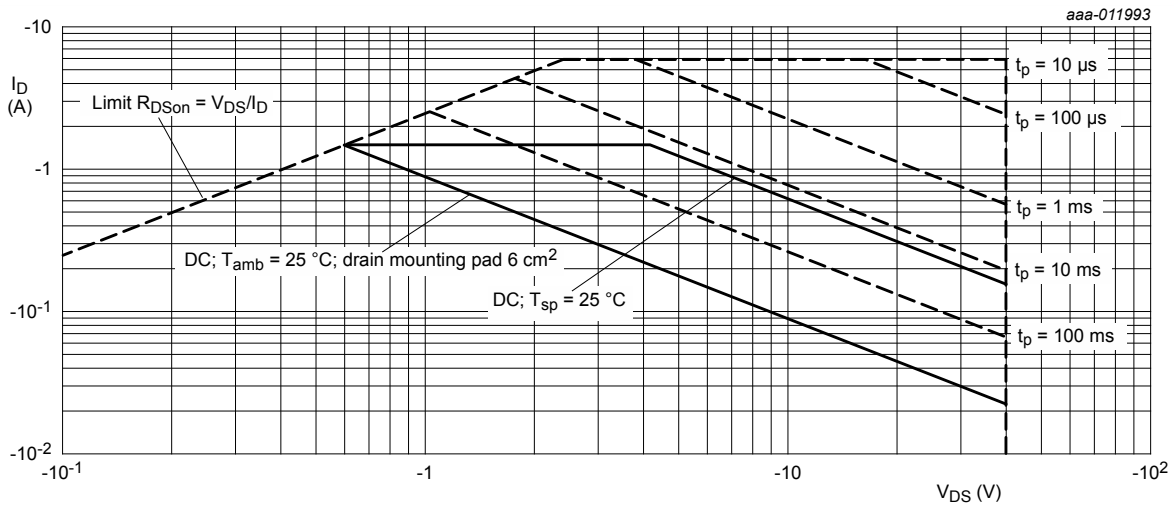


Fig. 2. Normalized continuous drain current as a function of junction temperature

$$I_{der} = \frac{I_D}{I_{D(25^\circ\text{C})}} \times 100 \%$$



I_{DM} = single pulse

Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	230	260	K/W
			[2]	-	120	140	K/W

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	15	20	K/W

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 6 cm².

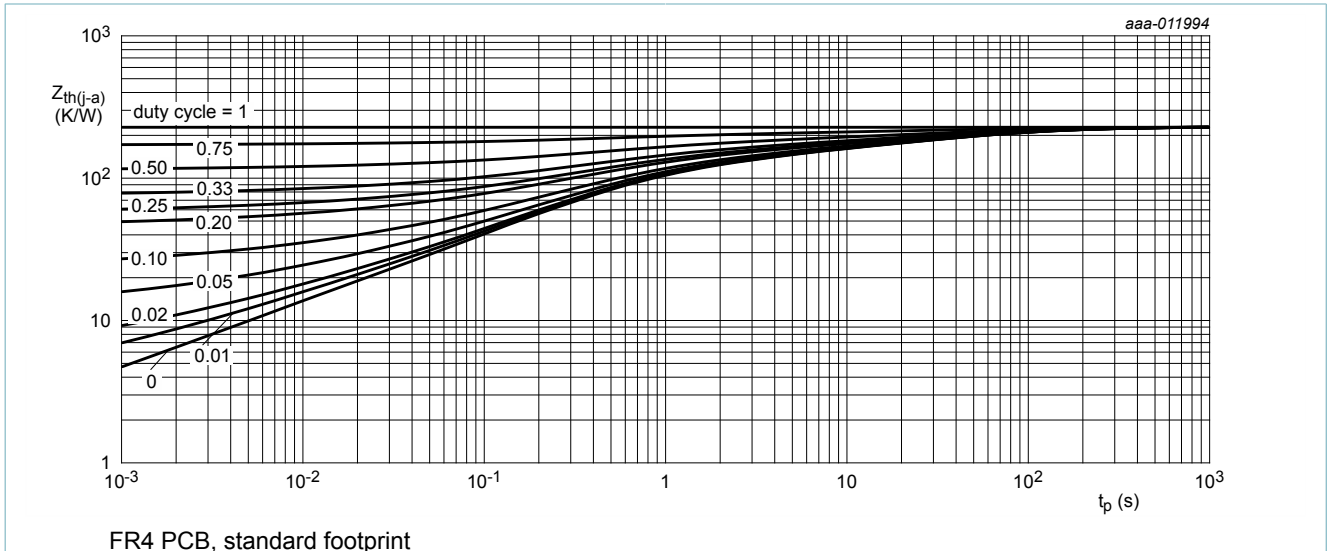


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

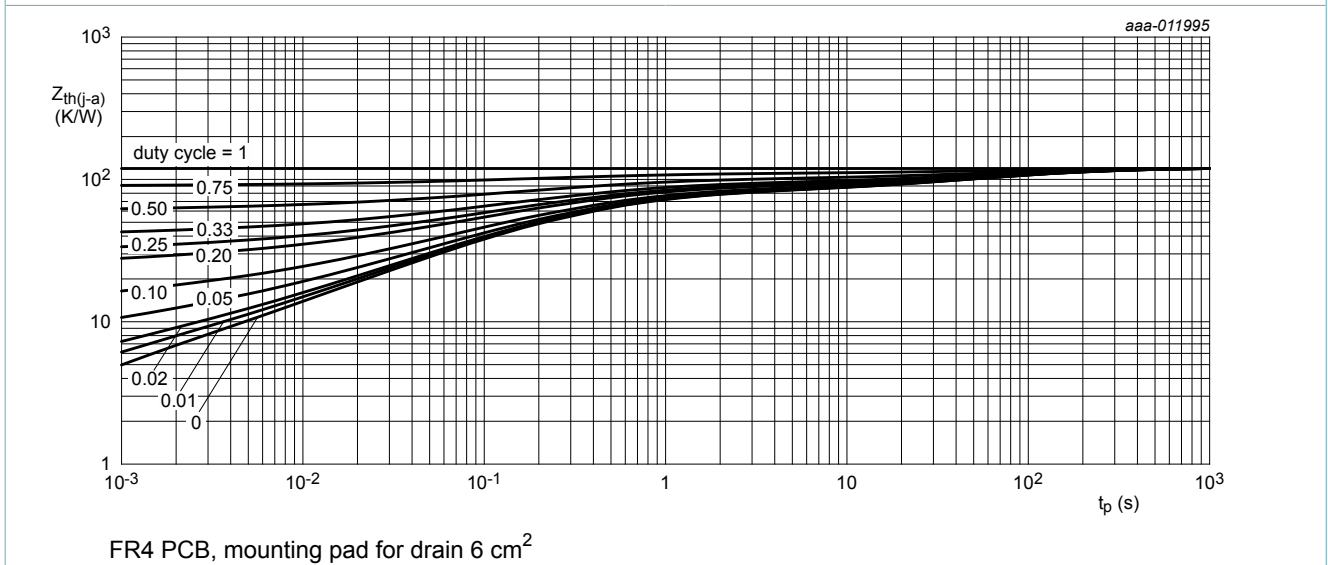


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = -250 \mu A$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-40	-	-	V
V_{GSth}	gate-source threshold voltage	$I_D = -250 \mu A$; $V_{DS} = V_{GS}$; $T_j = 25 \text{ }^\circ C$	-1	-1.7	-2.5	V
I_{DSS}	drain leakage current	$V_{DS} = -40 V$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-	-1	μA
		$V_{DS} = -40 V$; $V_{GS} = 0 V$; $T_j = 150 \text{ }^\circ C$	-	-	-20	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 V$; $V_{DS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-	10	μA
		$V_{GS} = -20 V$; $V_{DS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-	-10	μA
R_{DSon}	drain-source on-state resistance	$V_{GS} = -10 V$; $I_D = -1.3 A$; $T_j = 25 \text{ }^\circ C$	-	180	240	m Ω
		$V_{GS} = -10 V$; $I_D = -1.3 A$; $T_j = 150 \text{ }^\circ C$	-	300	400	m Ω
		$V_{GS} = -4.5 V$; $I_D = -0.8 A$; $T_j = 25 \text{ }^\circ C$	-	220	300	m Ω
g_{fs}	forward transconductance	$V_{DS} = -5 V$; $I_D = -2 A$; $T_j = 25 \text{ }^\circ C$	-	4.5	-	S
R_G	gate resistance	$f = 1 \text{ MHz}$	-	19	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$V_{DS} = -20 V$; $I_D = -1.3 A$; $V_{GS} = -10 V$; $T_j = 25 \text{ }^\circ C$	-	4.7	6	nC
Q_{GS}	gate-source charge		-	0.8	-	nC
Q_{GD}	gate-drain charge		-	0.7	-	nC
C_{iss}	input capacitance	$V_{DS} = -20 V$; $f = 1 \text{ MHz}$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	293	450	pF
C_{oss}	output capacitance		-	35	-	pF
C_{rss}	reverse transfer capacitance		-	20	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = -20 V$; $I_D = -1.3 A$; $V_{GS} = -10 V$; $R_{G(ext)} = 15 \Omega$; $T_j = 25 \text{ }^\circ C$	-	4	6	ns
t_r	rise time		-	6	-	ns
$t_{d(off)}$	turn-off delay time		-	26	39	ns
t_f	fall time		-	14	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = -0.86 A$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-0.8	-1.2	V

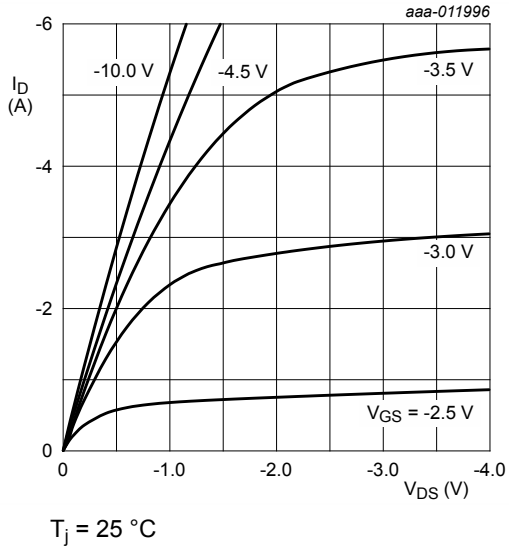


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

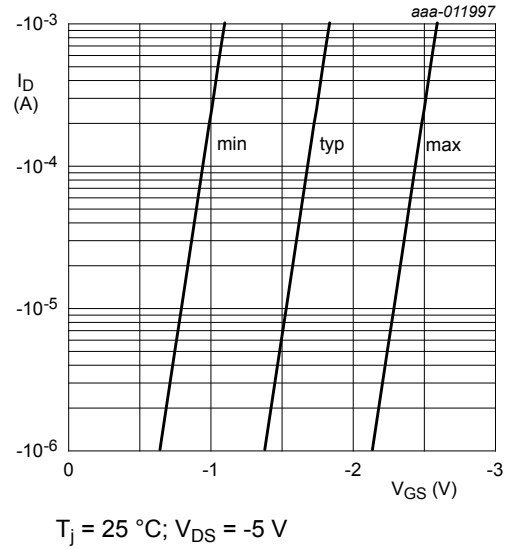


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

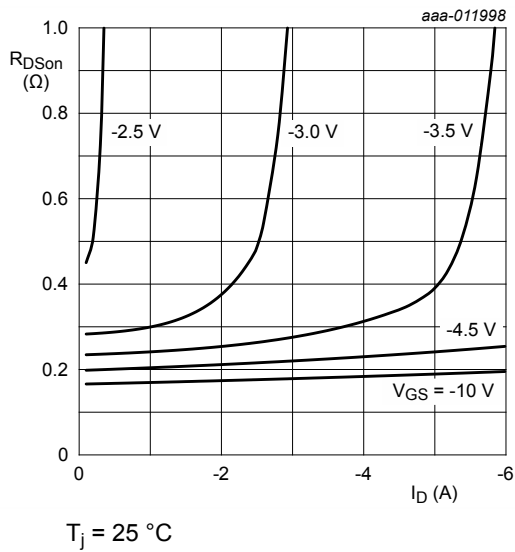


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

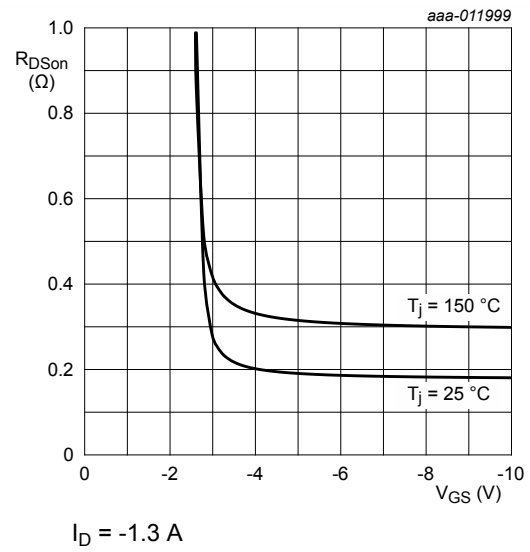


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

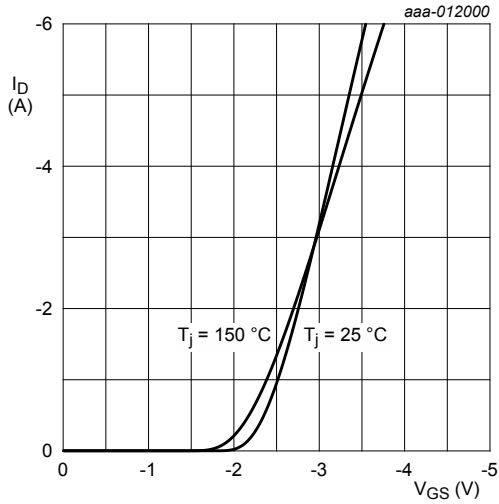


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

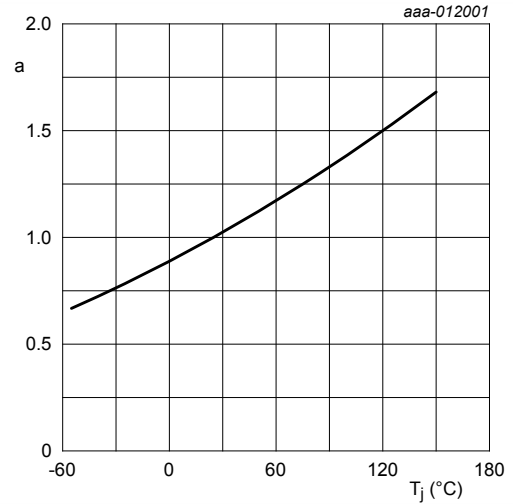


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

$$a = \frac{R_{DSon}}{R_{DSon(25^\circ C)}}$$

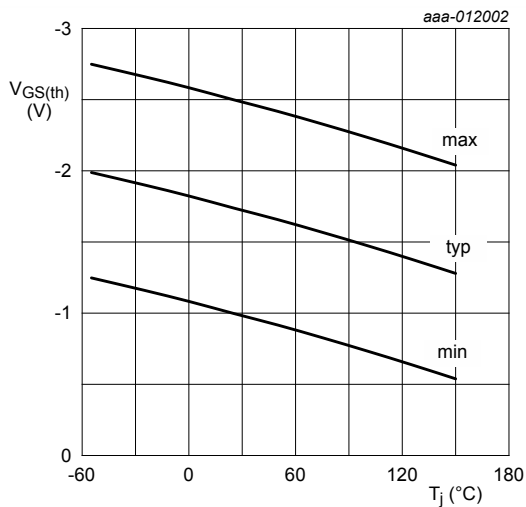


Fig. 12. Gate-source threshold voltage as a function of junction temperature

$I_D = -0.25 \text{ mA}; V_{DS} = V_{GS}$

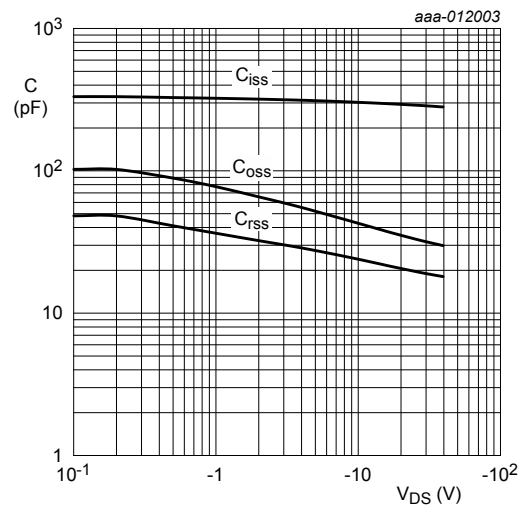
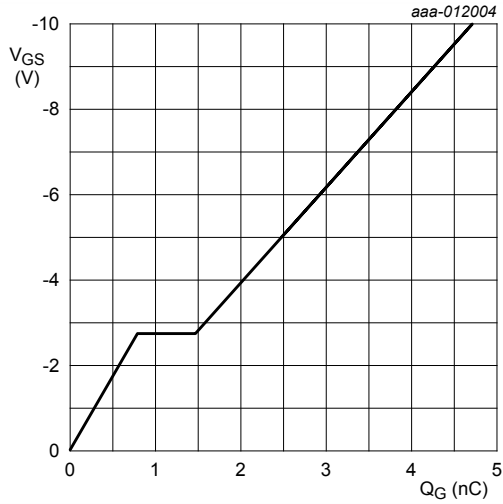


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

$f = 1 \text{ MHz}; V_{GS} = 0 \text{ V}$



$I_D = -1.3 \text{ A}; V_{DS} = -20 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$

Fig. 14. Gate-source voltage as a function of gate charge; typical values

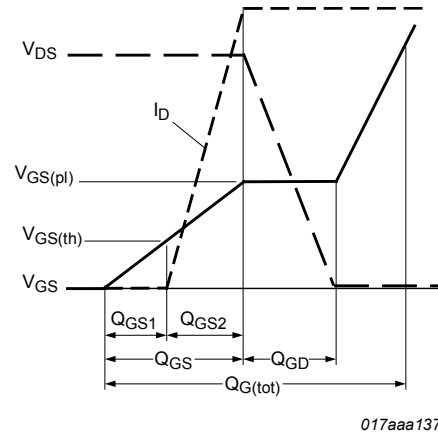
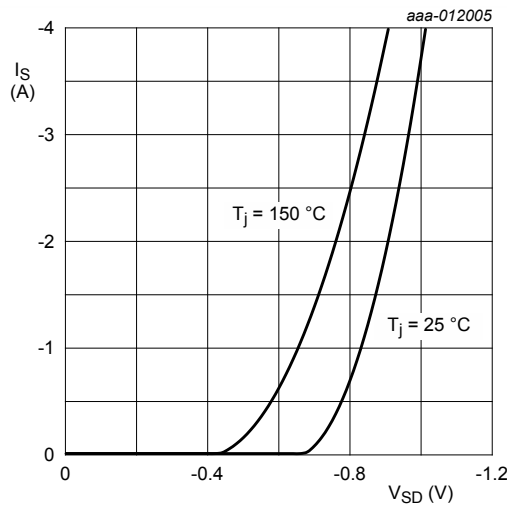


Fig. 15. MOSFET transistor: Gate charge waveform definitions



$V_{GS} = 0 \text{ V}$

Fig. 16. Source current as a function of source-drain voltage; typical values

11. Test information

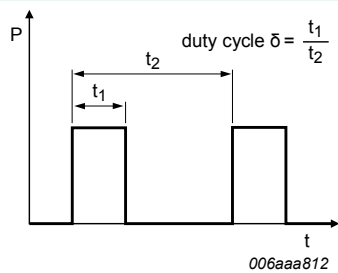


Fig. 17. Duty cycle definition

11.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.

12. Package outline

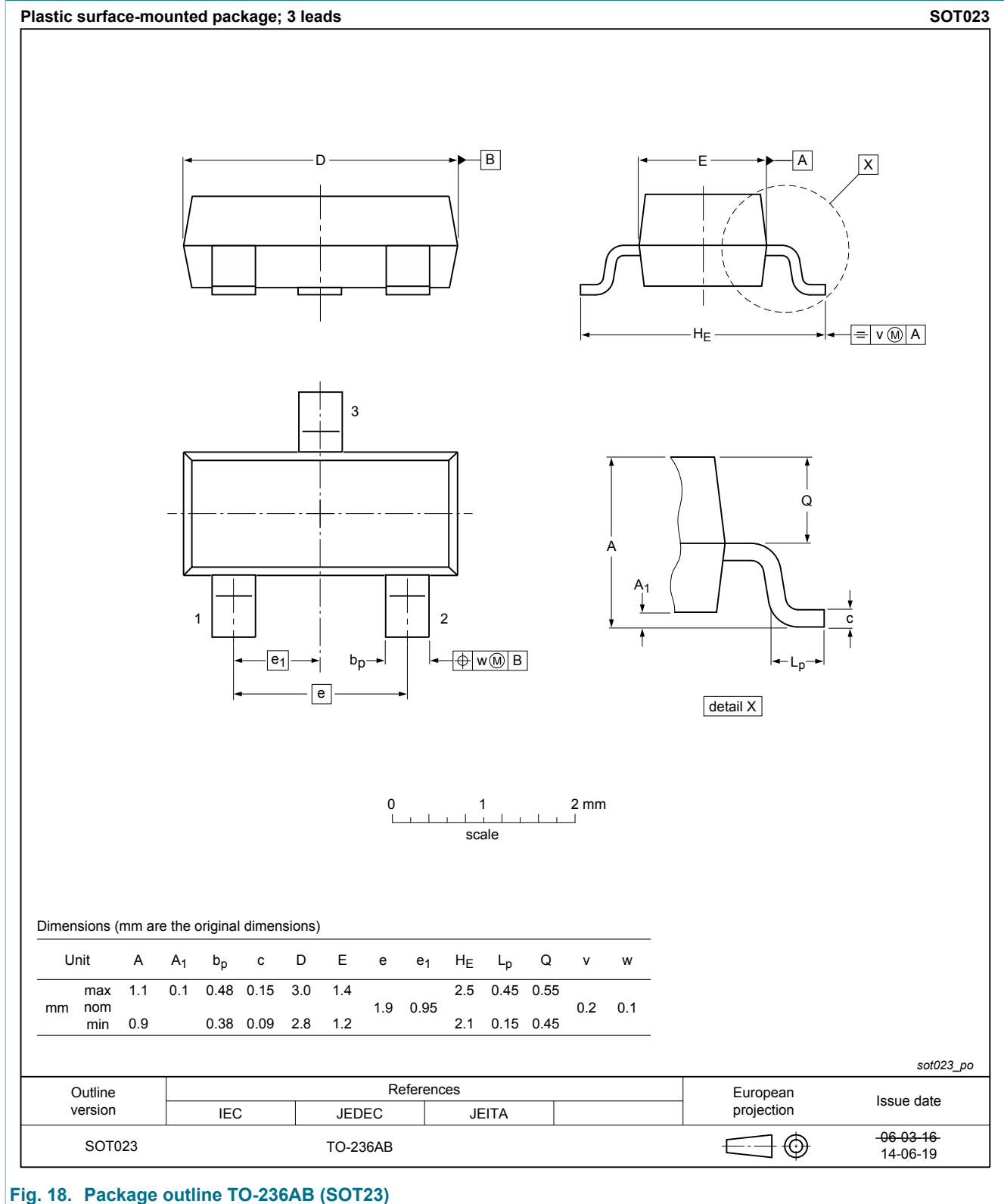


Fig. 18. Package outline TO-236AB (SOT23)

13. Soldering

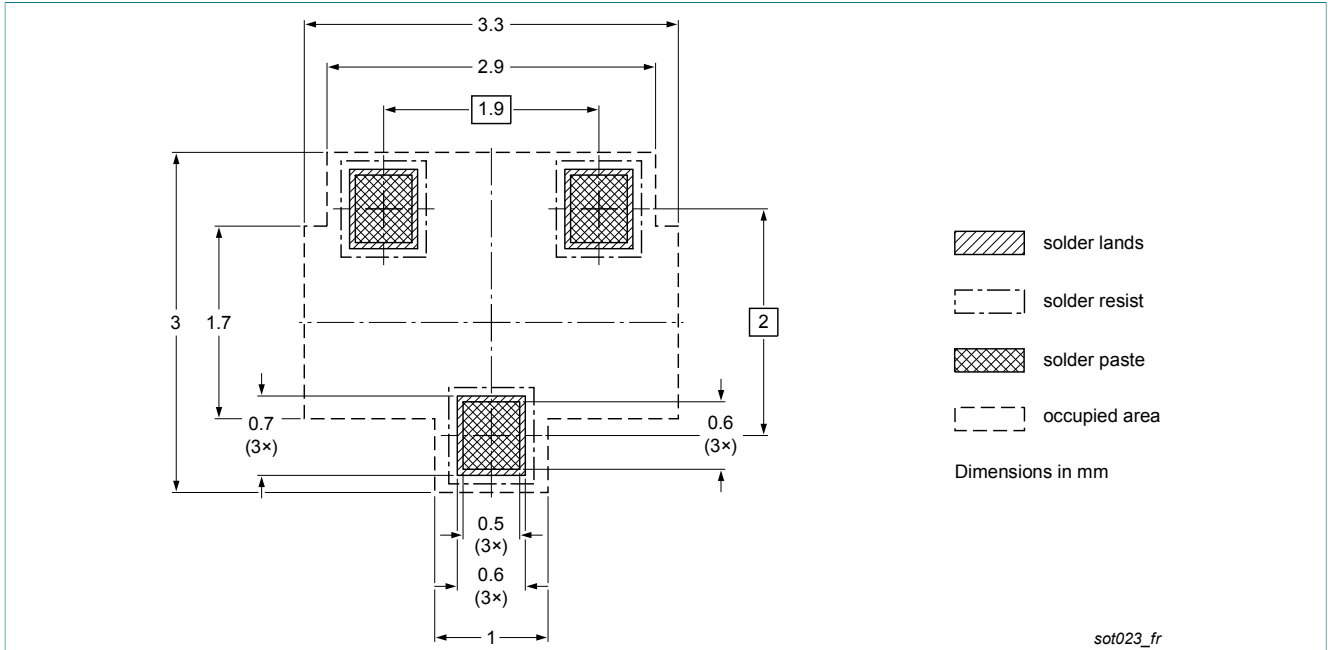


Fig. 19. Reflow soldering footprint for TO-236AB (SOT23)

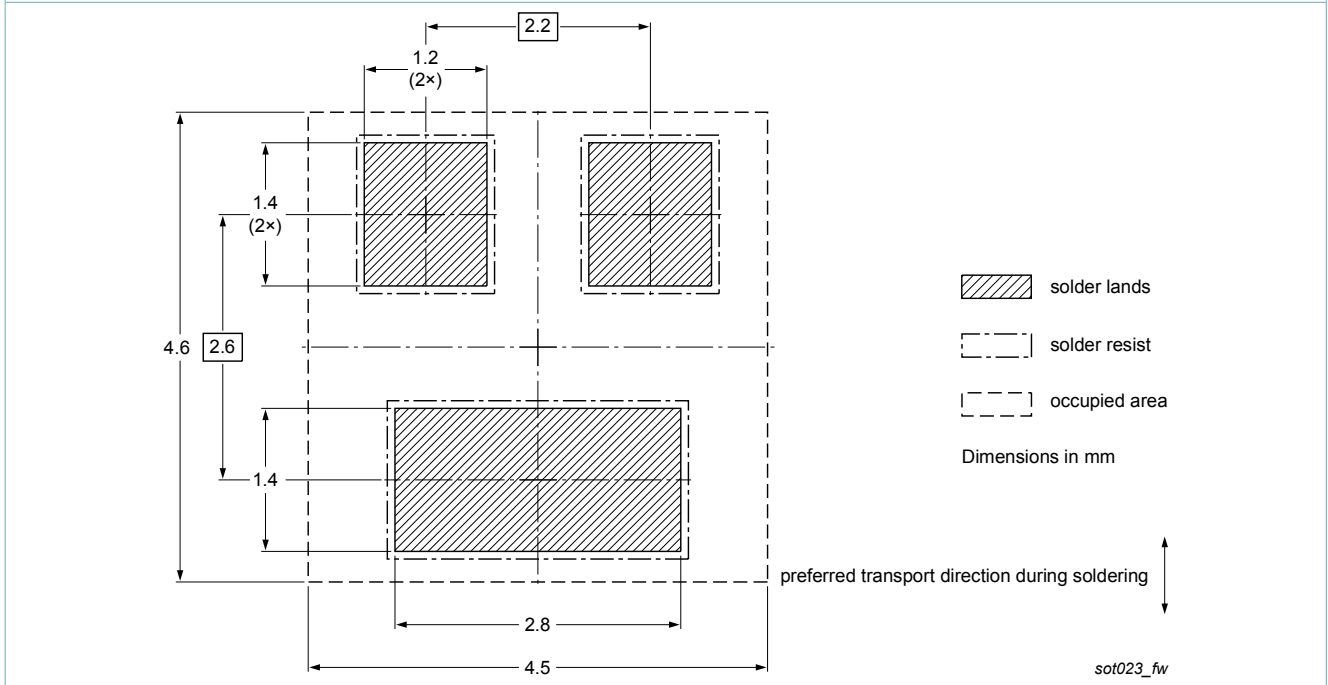


Fig. 20. Wave soldering footprint for TO-236AB (SOT23)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMV250EPEA v.3	20140620	Product data sheet	-	PMV250EPEA v.2
Modification: Soldering chapter added				
PMV250EPEA v.2	20140612	Product data sheet	-	PMV250EPEA v.1
PMV250EPEA v.1	20140312	Preliminary data sheet	-	-

15. Legal information

15.1 Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 20 June 2014